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The Missing Link: Are Individuals with More Social Capital in Better Health? Evidence from India

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The Missing Link: Are Individuals with More Social Capital in Better Health? Evidence from India*

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1 Introduction

In recent years, there has been an increasing interest in the role of social capital in a wide range of fields. Along with this growth in discussion on the subject, to date, there has been, however, little agreement on the term "social capital" among social and political scientists, and economists alike. It is now well established from a proliferation of studies (e.g., Hanifan, 1916; Jacobs, 1961; Bourdieu, 1986; Loury, 1987; Coleman, 1990; Putnam, 1993 and 2000; Fukuyama, 1995; Putterman, 1995; Knack and Keefer, 1997; Dasgupta, 2003; Durlauf and Fafchamps, 2005; Sabatini, 2005) that social capital is a sociological concept and is generally understood to mean connections within and among social networks. In his incisive book *"Bowling Alone: The Collapse and Revival of American Community"*, Putnam (2000), for instance, provided a critical analysis of key perspectives and debates on the term "social capital".

In the last few decades, there is, on one hand, an ever-increasing number of studies that recognises the importance of the relationship between human capital and social capital (e.g., Wolfinger and Rosenstone, 1980; Coleman, 1988; Smith, 1994; Wilson, 2000; OECD, 2001; Putnam, 2000; Jones, 2006; OECD, 2010; Alpaslan, 2017). There is, on the other hand, a growing body of literature (e.g., Kawachi and Berkman, 2000; Kawachi and Berkman, 2001; Stephens et al., 2004; Viswanath et al., 2006; McKenzie, 2006; Scheffler and Brown, 2008) that describes the link between social capital and health. In a fashion similar to human capital which is already known in the literature to be among the most important factors for health[1], prior studies (e.g., Rose, 2000; Hyyppä and Mäki, 2001; Lindström, 2004; Mohseni and Lindström, 2007;

[1]See, for instance, Grossman (1972), Rosenzweig and Schultz (1983), Grossman and Kaestner (1997), Grossman (2000), Grossman (2005), Goldman and Smith (2005), Arendt (2005), Lleras-Muney (2005), Tamura (2006), Grimard and Parent (2007), De Walque (2007), Albouy and Lequien (2009), Cutler and Lleras-Muney (2010), Webbink et al. (2010), Agénor (2012), and Clark and Royer (2013), among others.

d'Hombres et al., 2009; OECD, 2010) have consistently shown that individual-level social capital is fast becoming a key instrument in improving the health status and productivity of individuals and groups. Moreover, this is evident in the case of the *"Roseto Mystery"*, which was broadly discussed in Gladwell (2008)'s landmark book entitled "*Outliers: the Story of Success"*, implying that people who are more socially connected to community are physically healthier and live longer than people who are less connected. Conversely, people who are more isolated from the community find that their health and well-being decline earlier in midlife, and they even experience mental health disorders and live shorter lives.

In view of all that has been mentioned so far, one may, however, suppose that what remains poorly understood is the actual relationship between social capital, human capital, and health outcomes. Indeed, results from earlier studies (e.g., Ross and Wu, 1995; Miller et al., 2006) demonstrate a strong and consistent association between social capital, human capital, and health. For example, Ross and Wu (1995) have reported that social capital can act as a moderating factor between education and health outcomes. Likewise, Miller et al. (2006) provide evidence for Indonesia that social and human capital could be both a contributing factor to health outcomes. The core idea is that individuals with higher levels of education and social integration tend to live a longer and healthier life than their worse-off counterparts. Or more precisely, highly-educated individuals would develop better social networks and become more socially integrated in a community; but previous studies, for instance, for the U.S. (e.g., Berkman and Syme, 1979; House et al., 1988; Kawachi et al., 1996; Eng et al., 2002; Lochner et al., 2003; Scheffler et al., 2008) have, at the same time, revealed that individuals who have more robust social networks and community ties are less likely to have high mortality rates and health problems, such as cardiovascular disease and stroke than people who are less socially integrated. A number of studies in other OECD countries, such as United Kingdom, Sweden, and Finland (e.g., Mohan et al.,

2005; Poortinga, 2006; Lofors and Sundquist, 2007; Sundquist and Yang, 2007; Olsen and Dahl, 2007) have also provided reasonably consistent evidence of an association between social capital and health. However, Helliwell and Putnam (2007) hold the view that the extent to which social capital determines health is causally associated with the average level of education. In other words, education level exerts an indirect effect on health through social capital. Considering all of this evidence, it seems that previous research has failed to demonstrate any convincing evidence of the connection between human capital, social capital, and health outcomes and their collective effect on economic growth for low-income countries.

In recent years, there has been an increasing amount of growth literature on social capital (e.g., Routledge and von Amsberg, 2003; Chou, 2006; Growiec and Growiec, 2012; Agénor and Dinh, 2015; Bofota et al., 2016; Alpaslan, 2017; Ponzetto and Troiano, 2018), yet Alpaslan (2017) has gone some way towards enhancing our understanding of the relationship between social capital and human capital. In a two-period Overlapping Generations (OLG) model, Alpaslan (2017) provided endogenous growth model-based evidence of a two-way relationship between social capital and human capital for a low-income country, India which has been reported to have one-third of population living below the official poverty line. In a numerical analysis of his study, a trade-off has been found to be related to two productive components of public spending: social capital-related activities and education, and this trade-off may go either way. Interestingly, further analysis showed that the trade-off fades away under a different set of parameter values, provided that a higher share of public spending on education is achieved at the expense of social capital-related activities.

The present study makes several noteworthy contributions to the existing literature: previous studies have reported that social capital determines health outcomes; however, the extent to which it benefits from social capital depends heavily on human capital, as mentioned earlier. This paper first offers an extended version of

the model in Alpaslan (2017) for a low-income country, India to critically examine associations between human capital, social capital, and health outcomes in the context of an endogenous growth model. The reason why we chose, in particular, India is because it is a country with 29 states and 7 union territories, each of which has a particular set of social values and norms so our country choice allows us to test the implications of the theoretical model. Second, in an attempt to detect the interaction effect between these three variables, a unique dataset, where micro-level data from the World Values Survey (WVS) and regional-level macro data from the Central Statistics Office of India were both utilised, was accessed. A three-equation model has been then estimated using the conditional mixed-process (CMP) method in order to explicitly address endogeneity issues. Our estimation results provide important insights into the theoretical thesis in several ways. Firstly, human capital has a favourable impact upon social capital, which in turn enhances self-reported health. Secondly, we provide a comparison of three main experiments: an increase in the share of public spending by region on education, social capital-enhancing activities, and health. The results confirm the positive effect of an increase in each form of government spending on outcome variables. Thirdly, the correlation coefficient between disturbances of these three equations turns out to be statistically significant, suggesting that there are unobserved factors, which can affect self-reported health, social capital and human capital variables.

The remaining part of the paper proceeds as follows: Section 2 begins by laying out the theoretical model. Section 3 presents the empirical model by which the analyses were conducted and discusses the principal findings. The final section ties together the theoretical and empirical strands, and provides a brief summary of the empirical findings.

2 The Theoretical Model

Following Alpaslan (2017, pp.862-867), unless otherwise stated, for the model definition, which itself draws on Agénor and Dinh (2015, pp.43-48), we briefly identify the characteristics of a two-period (adulthood and old age) OLG model of endogenous economic growth: The economy we consider is populated by nonaltruistic individuals, firms and a government. Firms produce a single, nonstorable physical good. The government chooses to run a balanced budget and government spending includes productive items: education, social capital-related activities, and health as well as other (unproductive) items; however, the government imposes a tax on only wage incomes of adult workers to finance its expenditures. And finally, all markets clear in equilibrium.

We now turn our attention to the identification of the model in detail: individuals, firms, human capital, social capital, health status, productivity, and survival rate, government, market-clearing conditions, and balanced growth equilibrium, respectively.

2.1 Individuals

The individual's discounted utility function is given by

$$U_t^h = \eta_C \ln c_t^{t,h} + \frac{q_t}{1+\rho} \ln c_{t+1}^{t,h}, \tag{1}$$

where $c_t^{t,h}(c_{t+1}^{t,h})$ consumption of individual h at period $t(t+1)$, $\eta_C > 0$ the individual's relative preference parameter for current consumption, $q_t \in (0,1)$ the probability of survival from adulthood to old age, and $\rho > 0$ the subjective discount rate.

We assume that there are no debts or bequests between generations, the period-specific budget constraints are given by

$$c_t^{t,h} + s_t^h = (1-\tau) E_t^h A_t^h w_t, \tag{2}$$

$$c_{t+1}^{t,h} = (1 + r_{t+1})s_t^h/q_t, \tag{3}$$

where w_t is the economy-wide wage rate, E_t^h individual human capital, A_t^h individual labour productivity in efficiency units; therefore $A_t^h E_t^h$, individual labour productivity, $\tau \in (0,1)$ a constant tax rate, s_t^h savings, and r_{t+1} the rental rate of private capital between periods t and $t+1$.

2.2 Firms

As in Agénor and Canuto (2015), there is a continuum of firms of measure one, and production of a single nonstorable good requires the use of effective labour, $A_t E_t N_t^i$, where A_t is average adult labour productivity, E_t average human capital of individuals born in $t-1$, and N_t^i the number of adult workers employed by firm i, and private capital of firm i, $K_t^{P,i}$. However, in accordance with the evidence in Guiso et al. (2009), the firm production function also depends on average social capital of the previous generation, K_t^S. Suppose that the production function has constant returns to scale in private inputs, the production function of individual firm i follows that:

$$Y_t^i = (K_t^S)^\alpha (A_t E_t N_t^i)^\beta (K_t^{P,i})^{1-\alpha-\beta}, \tag{4}$$

where $\alpha, \beta \in (0,1)$ is the elasticity with respect to social capital stock and effective labour, respectively.

Aggregate output takes a linear form in private capital:

$$Y_t = \int_0^1 Y_t^i di = (k_t^S)^\alpha e_t^\beta A_t^\beta \bar{N}^\beta K_t^P, \tag{5}$$

where $K_t^P = K_t^{P,i}$, $\forall i$, $\bar{N} = \int_0^1 N_t^i di$ is total population, $k_t^S = K_t^S/K_t^P$ is the social capital-private capital ratio and $e_t = E_t/K_t^P$ is the human capital-private capital ratio.

2.3 Human Capital

The individual stock of human capital at the beginning of period $t+1$ depends on government spending per capita, $G_t^E/\bar{N}$, and the average human capital of the previous generation, E_t.[2]

$$E_{t+1}^h = (\frac{G_t^E}{\bar{N}})^{\nu_1} E_t^{1-\nu_1}, \tag{6}$$

where $\nu_1 \in (0,1)$ is the elasticity with respect to government spending on education and therefore $1-\nu_1$ is the elasticity with respect to the average human capital of the previous generation, respectively.

2.4 Social Capital

Although there has been much division among economists on the subject of "capital", what is agreed that similar to human capital, social capital is an asset that individuals can invest in and is an important aspect of economic development, and therefore needs to be addressed. As argued by Alpaslan (2017), the individual stock of social capital at the beginning of period $t+1$ is determined by parent's average human and social capital, as well as government spending on social capital-related activities, which can strengthen legal system, contract enforcement, and institutional trust in political institutions, the judiciary, police, the media or other institutions and so on.[3]

$$K_{t+1}^{S,h} = (\frac{G_t^S}{\bar{N}})^{\lambda_1} E_t^{\lambda_2} (K_t^S)^{1-\lambda_1-\lambda_2}, \tag{7}$$

where G_t^S government spending on social capital-related activities, E_t and K_t^S parent's average human and social capital, respectively. Also $\lambda_i \in (0,1)$, $i = 1,2$; the elasticity with respect to public spending on social capital-related activities and average human capital of the previous generation, respectively.

[2]In addition to these variables, Agénor and Dinh (2015) also considered the stock of imitated goods, as well as a fixed fraction of time spent in schooling to account for the human capital stock of individuals; however, we have abstracted from these issues.

[3]See, for instance, Scrivens and Smith (2013) for further discussion.

2.5 Health Status, Productivity, and Survival Rate

As in Agénor (2012, Chapter 3), health status of individuals depends on the government provision of health care services, which is assumed to be linear in public spending on health services, G_t^H. This is, however, subject to congestion by the private capital stock, K_t^P, due to the excessive use of public infrastructure assets by the private sector.[4] The evidence reviewed in the introduction section supports the notion that individuals' health status is determined by the average social capital of the previous generation, K_t^S, and the average human capital of the previous generation, E_t. Assuming constant returns to scale in private inputs, health status of individuals is then:

$$H_{t+1}^h = (\frac{G_t^H}{K_t^P})^{\kappa_1}(K_t^S)^{\kappa_2} {E_t}^{1-\kappa_2}, \tag{8}$$

where $\kappa_i \in (0,1)$, $i = 1,2,3$.

In line with Agénor and Canuto (2015), adult productivity depends on health status of individuals but is subject to decreasing marginal returns:[5]

$$A_{t+1}^h = (H_{t+1}^h)^{\kappa_p}, \tag{9}$$

where $\kappa_p \in (0,1)$.

Also, as stated in their paper, the survival rate from adulthood to old age depends on health status of individuals which is also determined by both social and human capital stocks:

$$q_t = q_L + \bar{q}(\frac{H_t^h}{1+H_t^h})^{\nu_Q}, \tag{10}$$

where $q_0 = q_L$ and $\lim_{e_t \to \infty} q_t = q_L + \bar{q} \leqslant 1$, $\nu_Q > 0$.

[4] See, for instance, Agénor et al. (2012) for further discussion.

[5] See Bloom and Canning (2005), and Cole and Neumayer (2006) for further discussion.

2.6 Government

As discussed earlier, the government taxes only wage incomes of adult workers, its balanced budget is:

$$G_t = \sum G_t^j = \tau E_t A_t w_t \bar{N}, \quad j = E, S, H, O \tag{11}$$

where G_t^E, G_t^S, G_t^H, or G_t^O share of public spending on education, social capital-related activities, health, and other (not directly productive) items, respectively.

It has been assumed that shares of public spending are constant fractions of government revenues:

$$G_t^j = \upsilon_j \tau E_t A_t w_t \bar{N}, \quad j = E, S, H, O \tag{12}$$

where $\upsilon_j \in (0, 1)$ for all j.

Combining (11) and (12) therefore yields

$$\sum_j \upsilon_j = 1. \tag{13}$$

2.7 Market-Clearing Conditions

The asset market clearing condition is that tomorrow's private capital stock is a linear function of today's savings by adult workers. In addition, for simplicity, full depreciation is assumed:

$$K_{t+1}^P = \bar{N} s_t, \tag{14}$$

where s_t is savings per individual and $\bar{N}$ is the number of adult workers, as noted earlier.

2.8 Balanced Growth Equilibrium

As in Agénor et al. (2014, p.138) and Agénor and Dinh (2015, pp.47-48), a *competitive equilibrium* in this model is a sequence of allocations $\{c_t^t, c_{t+1}^t, s_t\}_{t=0}^{\infty}$, physical

capital stock $\{K_t^P\}_{t=0}^{\infty}$, human capital stock $\{E_t\}_{t=0}^{\infty}$, social capital stock $\{K_t^S\}_{t=0}^{\infty}$, factor prices $\{w_t, r_t\}_{t=0}^{\infty}$, a constant tax rate, and public spending shares such that, given initial stocks and health status $K_0^P > 0$, $K_0^S > 0$, $E_0 > 0$, $H_0 > 0$, individuals maximise utility, firms maximise profits, markets clear, and the government budget is balanced. In a symmetric equilibrium, it must be also that $c_t^{t,h}(c_{t+1}^{t,h}) = c_t^t(c_{t+1}^t)$, $s_t^h = s_t$, $E_t^h = E_t$, $K_t^{S,h} = K_t^S$, $H_t^h = H_t$, $A_t^h = A_t$, $\forall h$. A *balanced growth equilibrium* is a competitive equilibrium in which c_t^t, c_{t+1}^t, s_t, K_t^P, K_t^S, E_t, H_t and Y_t grow at the constant rate $1 + \boldsymbol{\gamma}$, the rate of return on private capital, r_t, and the economy-wide wage rate, w_t, are constant.

The dynamic system consists of three nonlinear first-order difference equations in $e_t = E_t/K_t^P$, the human capital-private capital ratio, $k_t^S = K_t^S/K_t^P$, the social capital-private capital ratio, and health status in adulthood, H_t. The steady-state growth rate of the economy is then given by:

$$1 + \boldsymbol{\gamma} = (\tilde{k}^S)^{\alpha} \tilde{e}^{\beta} \tilde{H}^{\beta\kappa_p} \bar{N}^{\beta} \tilde{\sigma}(1-\tau)\beta, \tag{15}$$

where steady-state values of the relevant variables are denoted by superscript "$\sim$".

3 Empirical Evidence

3.1 Data Collection and Variables

This paper utilises a unique dataset that links individual-level survey data to regional data for India. Data were gathered from multiple sources. For the individual-level data, we rely on World Values Survey (WVS) wave 6, which covers the period from 2010 to 2014[6]. One potential advantage of using this survey data is that we obtain the information about individual differences in personal beliefs and values, gender

[6]Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). 2014. World Values Survey: Round Six - Country-Pooled Datafile Version: http://www.worldvaluessurvey.org/WVSDocumentationWV6.jsp. Madrid: JD Systems Institute.

equality, social capital, and subjective well-being, as well as the state of residence at regional level. State-wise data are obtained from the Central Statistics Office of India, whereas we draw upon Mundle et al. (2016) for the governance index that measures the governance performance of Indian states. Data on voter turnout rates for 2009 general elections are based on the Election Commission of India. India has a federal system of governance, which consists of 29 states and 7 union territories. The 2012 WVS was, however, conducted in 16 states and 1 union territory of India.

Our variables of primary interest are social capital, human capital, and self-reported health. The following survey question: "All in all, how would you describe your state of health these days" helps us identify our variable for self-reported health. In response to this question, answers are given on a 1-4 scale (1: 'very good', 4: 'poor'); however, just to be consistent with data obtained in earlier studies, these answers have been recoded in the opposite way (1: 'poor', 4: 'very good'). The highest education level that individuals attain (from 1: 'no formal education' to 9: 'university-level education with degree') has been used as a proxy for human capital. For income group variable, there are 10 response categories in the survey (from 1: 'lowest' to 10: 'highest income group') where each respondent belongs to one income category. The WVS Wave 6 survey data are, on the other hand, useful for identifying respondents' social class, migration background, and religion. In this respect, respondents are asked to describe the social class they belong to (from 1: 'upper class' to 5: 'lower class'). In addition, a dummy variable is used and it takes value one if either of parents has migrated to India, and zero otherwise. Respondents are considered religious if they describe themselves as such in response to the following question in the survey: "Independently of whether you attend religious services or not, would you say you are?"

Social capital is a concept difficult to define precisely. While a variety of definitions of social capital have been suggested, generalised trust is a commonly-used

proxy in the literature. We therefore use the same proxy as in the literature for our analysis. In the survey, respondents are asked to answer the following question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" A binary variable (trust) is used and it takes value one if the response is "most people can be trusted", and zero otherwise. Although widely varying definitions of social capital have emerged in the literature, as mentioned earlier, its generally accepted definition embodies structural (social structure) and cognitive (shared understandings) concepts (Nahapiet and Ghoshali, 1998; Ferlander, 2007). We have therefore used two other indicators for social capital to perform robustness checks: institutional trust as an indicator for cognitive social capital and informal trust for structural social capital. In the survey, respondents are asked about their level of confidence in their country's parliament, legal system, police, politicians, political parties, the South Asian Association for Regional Co-operation (SAARC), and the United Nations. However, we exclude confidence in international organisations from our analysis as the focus of this paper is on domestic institutions and their respective performance. A categorical variable on 'institutional trust' is used and it ranges from 1 (if individual has confidence in at least 4 out of listed institutions) to 5 (if individual has confidence in more than 16 out of listed institutions). In our study, a dummy variable for informal trust is also used: it takes value one if friends play an important role in respondents' life, and zero otherwise. Data description and its sources, as well as descriptive statistics are presented in the appendix.

3.2 Empirical Model

In an attempt to empirically test the hypothesis that has been suggested in the theoretical model, this paper employs a simultaneous equation system with three

equations, each of which has a number of dependent variables:

$$H_{ij} = \alpha_0 + \alpha_1 SC_{ij} + \alpha_2 healthexp_j + \alpha_3 govexpnetofhealth_j + X_{ik}\phi_{ik} + \varepsilon_h, \quad (16)$$

$$SC_{ij} = \beta_0 + \beta_1 HC_{ij} + \beta_2 admexp_j + \beta_3 govexpnetofadm_j + \beta_4 statewise\ governance\ index_j + X_{ik}\mu_{ik} + \varepsilon_{sc}, \quad (17)$$

or alternatively,

$$SC_{ij} = \beta_0 + \beta_1 HC_{ij} + \beta_2 admexp_j + \beta_3 govexpnetofadm_j + \beta_4 unemployment\ rate_j + X_{ik}\mu_{ik} + \varepsilon_{sc}, \quad (18)$$

$$HC_{ij} = \gamma_0 + \gamma_1 educationexp_j + \gamma_2 govexpnetofeducation_j + \gamma_3 literacy\ rate_j + X_{ik}\varphi_{ik} + \varepsilon_{hc}, \quad (19)$$

where H_{ij} is ordinal variable of individual self-reported health, whereas SC_{ij} (HC_{ij}) is individual social capital (human capital), together with i, j = individual and region, respectively. ε_h, ε_{sc}, and ε_{hc} are the error terms and they are assumed to be normally distributed with zero mean, unit variance and correlation coefficient ρ. $X_i = (X_{1i}, X_{2i}, ..., X_{ki})$ is a $kx1$ vector of covariates. Government expenditure variables are defined as a share of GDP; $healthexp$ ($admexp$) is state-wise health (administrative) expenditure to GDP ratio, whereas $govexpnetofhealth$ ($govexpnetofadm$) is government expenditure net of health (administrative) to GDP ratio. This (administrative) type of government expenditure corresponds to government spending on social capital-enhancing activities defined in the theoretical model[7]. In a similar vein, $educationexp$ and $govexpnetofeducation$ are the ratios of state-wise education expenditure and government expenditure net of education to GDP, respectively.

As implied by the theoretical model, individual stocks of social and human capital also depend on the relevant capital stock of the previous generation, but data on these

[7]This type of government expenditure is listed under non-developmental expenditure and its components are as follows: secretariat-general services, district administration, police, public works, and others.

capital stocks are not available from the WVS. One can see from equations (17) and (19) that state-wise governance index and literacy rate were therefore used as a proxy, respectively; however, their regional averages were taken. In an alternative form of equation (18), state-wise unemployment rate was also considered for the individual social capital stock of the previous generation.

The correlation between the error terms of above three equations would capture the interdependence of unobserved components in self-reported health, social capital, and human capital. However, estimation methods for univariate models lead to inconsistent parameter estimates if error terms of these equations are affected by similar components. Roodman's (2009, 2011) conditional mixed-process (CMP) model allows us to deal with endogeneity issues by imposing restrictions on the correlation structure between the error terms. We therefore estimate our system of equations by employing his conditional maximum likelihood estimation method to obtain consistent and efficient estimates.

3.3 Discussion of the Benchmark Results

In order to investigate the interplay between our variables of primary interest, equations (16) to (19) were first estimated individually. Before moving on to discuss the findings, it is, however, important to note that number of observations is different for alternative estimations, this is because observations are omitted from the analysis due to missing values in the outcome (dependent) variables. The single equation (ordered) probit estimation results for these equations are shown in Table 1. Overall, our empirical findings indicate that statistically significant correlation was observed between human and social capital, and self-reported health. In fact, these results are consistent with the implications of our theoretical model: general trust has a positive impact on self-reported health, while education is an important determinant of general trust. There is also some evidence that a lower social class is known to be

associated with poor health, but this is only evident in the case of females. Similarly, being religious exerts a positive effect upon the level of general trust. Also, having at least one immigrant parent can positively impact on general trust and this result is in agreement with Ljunge's (2014) findings, which suggests a trust transmission effect. Any improvement in the social capital stock of the previous generation (proxied by state-wise voter turnout) was also found to be a factor related to general trust. On the other hand, age, gender, and having at least one immigrant parent have a detrimental effect on education, while income level and literacy rate are both a contributing factor for a higher level of education. In addition, government expenditure variables are all statistically significant and their signs provide further support for the hypothesis set out in the theoretical model.

[Table 1 about here]

In attempting to address the interdependencies between human and social capital, and self-reported health, equations (16) to (19) are estimated using Roodman's (2009, 2011) conditional mixed-process (CMP) method. Our empirical results are shown in Table 2 and Table 3, where dependent variables are self-reported health, general trust, education, respectively. CMP estimation results suggest that the correlation coefficient between disturbances of the equations (atanhrho) are statistically significant, indicating that single equation (ordered) probit estimates fail to capture the interdependencies between the outcome variables. It could be argued that these statistically significant results are due to unobserved factors that could impact on these outcome variables in either a positive or negative manner depending on the value of the correlation coefficient.

[Table 2 and Table 3 about here]

3.4 Robustness Checks

To test whether or not our empirical results are consistent with the predictions of the theoretical model, we have also considered alternative models where social capital is proxied by informal trust and institutional trust, respectively. In the first model where social capital is proxied by informal trust, development expenditure is used as an explanatory variable and this type of government expenditure is equal to the sum of government spending on social and economic services[8,9]. Equations are then as follows:

$$H_{ij} = \alpha_0 + \alpha_1 informal\ trust_{ij} + \alpha_2 healthexp_j + \alpha_3 govexpnetofhealth_j + X_{ik}\phi_{ik} + \varepsilon_h, \tag{20}$$

$$Informal\ trust_{ij} = \beta_0 + \beta_1 HC_{ij} + \beta_2 devexp_j + \beta_3 govexpnetofdev_j + \beta_4 unemployment\ rate_j + X_{ik}\mu_{ik} + \varepsilon_{informal\ trust}. \tag{21}$$

As for the second model, voter turnout rates for 2009 general elections are used as a proxy for the social capital stock of the previous generation, whereas social services expenditure is considered in the model as an explanatory variable. Equations take the form:

$$H_{ij} = \alpha_0 + \alpha_1 institutional\ trust_{ij} + \alpha_2 healthexp_j + \alpha_3 govexpnetofhealth_j + X_{ik}\phi_{ik} + \varepsilon_h, \tag{22}$$

$$Institutional\ trust_{ij} = \beta_0 + \beta_1 HC_{ij} + \beta_2 socialservicesexp_j + \beta_3 govexpnetofsocialservices_j + \beta_4 voter\ turnout\ rate_j + X_{ik}\mu_{ik} + \varepsilon_{institutional\ trust}. \tag{23}$$

[8]The components of government spending on social services are family welfare, water supply and sanitation, housing, urban development, welfare of scheduled castes, scheduled tribes and other backward classes, labour and labour welfare, social security and welfare, nutrition, and relief on account of natural calamities, respectively.

[9]Agriculture and allied activities, rural development, special area programmes, irrigation and flood control, energy, industry and minerals, transport and communications, science, technology and environment as well as general economic services are the components of government spending on economic services.

Human capital equation remains the same as before for both alternative models:

$$HC_{ij} = \gamma_0 + \gamma_1 educationexp_j + \gamma_2 govexpnetofeducation_j + \gamma_3 literacy\ rate_j + X_{ik}\varphi_{ik} + \varepsilon_{hc}, \tag{24}$$

The estimation results are shown in Table 4 and Table 5, respectively. The results of the first model further support the benchmark results and match those observed in earlier studies (e.g., Harpham et al., 2004; Yip et al., 2007; Fiorillo and Sabatini, 2015). Similary, the results from the second model in which institutional trust is used as a proxy for social capital also confirm the so-called relationship between the outcome variables. Indeed, these results agree with the findings of previous studies (e.g., Islam et al., 2006; Kim et al., 2008; Hurtado et al., 2011; Rocco et al., 2014; Vincens et al., 2018).

[Table 4 and Table 5 about here]

4 Concluding Remarks

This paper offered an extended version of the model for India in Alpaslan (2017) for better understanding the relationship between education, social capital, and health outcomes within the context of a two-period Overlapping Generations (OLG) model of endogenous growth. Fundamentally, individuals with higher levels of human capital and social capital tend to live longer and healthier life than their worse-off counterparts. To be more precise, highly-educated individuals would indeed develop better social networks and become more socially integrated in a community. Accordingly, individuals who are more socially connected to community are physically healthier and less likely to have health problems, as discussed earlier. In an attempt to test the so-called relationship between the variables in question, a unique dataset, where micro-level data from the World Values Survey (WVS) and regional-level macro data from the Central Statistics Office of India were both utilised, was

accessed. A three-equation model was then estimated using the conditional mixed-process (CMP) method in order to explicitly address endogeneity issues. Our estimation results provide important insights into the theoretical thesis in several ways. Firstly, human capital has a favorable impact upon social capital, which in turn enhances self-reported health. Secondly, we provide a comparison of three main experiments: an increase in the share of public spending by region on education, social capital-enhancing activities, and health. The results confirm the positive effect of an increase in each form of government spending on outcome variables. Thirdly, the correlation coefficient between disturbances of these three equations turns out to be statistically significant, suggesting that there are unobserved factors, which can affect self-reported health, social capital and human capital variables.

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Table 1: Single Equation Estimates (Model 1 and 2)

Variables	Health	General Trust		Education
		Model 1	Model 2	
Health Expenditure/GDP	3.863**			
	(1.60)			
Expenditure Net of	-0.272***			
Health/GDP	(0.072)			
General Trust	0.263***			
	(0.049)			
Age	-0.004			-0.058***
	(0.007)			(0.007)
Age Square/100	-0.031***			0.028***
	(0.008)			(0.007)
Class	-0.221***			
	(0.018)			
Female	-0.210***		0.007	-0.543***
	(0.036)		(0.051)	(0.035)
Administrative		0.321	1.832**	
Expenditure/GDP		(1.019)	(0.891)	
Expenditure Net of		-0.515***	-0.533***	
Administrative/GDP		(0.105)	(0.100)	
Education		0.0160*	0.023**	
		(0.009)	(0.010)	
Governance Index		0.289		
		(0.305)		
Unemployment Rate			-0.396***	
			(0.044)	
Parent Migrated		0.682***	0.669***	
		(0.093)	(0.093)	
Being Religious		0.157*	0.010	
		(0.085)	(0.086)	
Income Scale				0.168***
				(0.008)
Education				1.123**
Expenditure/GDP				(0.541)
Expenditure Net of				-0.184*
Education/GDP				
				(0.105)
Literacy Rate				0.014***
				(0.005)
cut1	-3.125***	0.668***	-0.472***	-1.295***
	(0.184)	(0.203)	(0.180)	(0.214)
cut2	-2.151***			-0.941***
	(0.182)			(0.214)
cut3	-0.833***			-0.562***
	(0.181)			(0.214)
cut4				-0.139
				(0.214)
cut5				0.345
				(0.213)

cut6				0.442**
				(0.213)
cut7				0.910***
				(0.213)
cut8				1.068***
				(0.212)
LR	$\chi2(7)$= 564.17	$\chi2(6)$= 98.41	$\chi2(7)$=171.54	$\chi2(7)$=1167.8
	[0.000]	[0.000]	[0.000]	[0.000]
Pseudo R^2	0.063	0.029	0.050	0.083
Log likelihood	-4196.48	-1673.23	-1636.84	-6971.07

Note (1): Robust standard errors in parentheses; p-values in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Note (2): Governance index and unemployment rate are used as a proxy in Model 1 and 2 for the social capital stock of the previous generation, respectively.

Table 2: CMP Estimation Results (Model 1)

Variables	Health	General Trust	Education	
Health	3.235**			
Expenditure/GDP	(1.453)			
Expenditure Net of	-0.119*			
Health/GDP	(0.070)			
General Trust	1.336***			
	(0.099)			
Age	-0.004		-0.059***	
	(0.006)		(0.007)	
Age Square/100	-0.018**		0.029***	
	(0.007)		(0.007)	
Class	-0.170***			
	(0.017)			
Female	-0.181***		-0.543***	
	(0.034)		(0.035)	
Administrative		1.899**		
Expenditure/GDP		(0.874)		
Expenditure Net of		-0.594***		
Administrative/GDP		(0.101)		
Education		0.0407**		
		(0.017)		
Governance Index		1.167***		
		(0.278)		
Parent Migrated		0.656***		
		(0.085)		
Being Religious		0.205***		
		(0.074)		
Income Scale			0.164***	
			(0.008)	
Education			1.298**	
Expenditure/GDP			(0.544)	
Expenditure Net of			-0.224**	
Education/GDP			(0.106)	
Literacy Rate			0.014***	
			(0.001)	
atanhrho_12				-0.764***
				-0.099
atanhrho_13				0.083***
				(0.020)
atanhrho_23				-0.060
				(0.049)
Number of Observations				3727

Note (1): Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Note (2): Governance index is used as a proxy in Model 1 for the social capital stock of the previous generation.

Table 3: CMP Estimation Results (Model 2)

Variables	Health	General Trust	Education	
Health Expenditure/GDP	5.522*** (1.466)			
Expenditure Net of Health/GDP	-0.204*** (0.067)			
General Trust	1.324*** (0.081)			
Age	-0.004 (0.006)		-0.058*** (0.007)	
Age Square/100	-0.0002** (0.0007)		0.0003*** (0.0007)	
Class	-0.164*** (0.017)			
Female	-0.190*** (0.036)	0.041 (0.054)	-0.544*** (0.035)	
Administrative Expenditure/GDP		1.093 (0.790)		
Expenditure Net of Administrative/GDP		-0.524*** (0.102)		
Education		0.035* (0.019)		
Unemployment Rate		-0.024*** (0.002)		
Parent Migrated		0.657*** (0.082)		
Being Religious		0.193** (0.075)		
Income Scale			0.164*** (0.008)	
Education Expenditure/GDP			1.270** (0.546)	
Expenditure Net of Education/GDP			-0.216** (0.107)	
Literacy Rate			0.014*** (0.002)	
atanhrho_12				-0.776*** (0.08)
atanhrho_13				0.085*** (0.020)
atanhrho_23				-0.023 (0.053)
Number of Observations				3727

Note (1): Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Note (2): Unemployment rate is used as a proxy in Model 2 for the social capital stock of the previous generation.

Table 4: Robustness (1)

Variables	Health	Informal Trust	Education	
Health	1.433			
Expenditure/GDP	(1.439)			
Expenditure Net of	-0.168**			
Health/GDP	(0.0685)			
General Trust	1.080***			
	(0.088)			
Age	-0.002	0.021**	-0.057***	
	(0.007)	(0.009)	(0.006)	
Age Square/100	-0.015**	-0.002**	0.027***	
	(0.007)	(0.009)	(0.007)	
Class	-0.152***			
	(0.0181)			
Female	-0.040	-0.193***	-0.526***	
	(0.038)	(0.054)	(0.035)	
Development		0.657***		
Expenditure/GDP		(0.106)		
Expenditure Net of		-0.543***		
Development/GDP		(0.119)		
Education		0.189***		
		(0.029)		
Unemployment Rate		-0.133***		
		(0.039)		
Parent Migrated			-0.183**	
			(0.078)	
Being Religious		0.101		
		(0.067)		
Income Scale			0.166***	
			(0.008)	
Education			1.352**	
Expenditure/GDP			(0.667)	
Expenditure Net of			-0.203	
Education/GDP			(0.132)	
Literacy Rate			0.014***	
			(0.001)	
atanhrho_12				-0.646***
				(0.073)
atanhrho_13				-0.036
				(0.023)
atanhrho_23				-0.064
				(0.076)
Number of Observations				3867

Note (1): Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Note (2): Informal trust is used as a proxy for social capital.

Table 5: Robustness (2)

Variables	Health	Institutional Trust	Education	
Health	0.898			
Expenditure/GDP	(1.77)			
Expenditure Net of	-0.251***			
Health/GDP	(0.071)			
General Trust	0.174***			
	(0.06)			
Age	-0.006	0.032***	-0.058***	
	(0.007)	(0.007)	(0.007)	
Age Square/100	-0.016**	-0.031***	0.029***	
	(0.007)	(0.007)	(0.007)	
Class	-0.183***			
	(0.019)			
Female	-0.163***		-0.535***	
	(0.041)		(0.034)	
Social Services		1.967***		
Expenditure/GDP		(0.365)		
Expenditure Net of		-0.047		
Social Services/GDP		(0.102)		
Education		0.212***		
		(0.015)		
Voter Turnout Rate		0.024***		
		(0.002)		
Parent Migrated		0.220***	-0.204***	
		(0.078)	(0.076)	
Income Scale			0.172***	
			(0.008)	
Education			2.253***	
Expenditure/GDP			(0.555)	
Expenditure Net of			-0.363***	
Education/GDP			(0.108)	
Literacy Rate			0.014***	
			(0.001)	
atanhrho_12				-0.165**
				(0.083)
atanhrho_13				0.066***
				(0.025)
atanhrho_23				-0.349***
				(0.048)
Number of Observations				3929

Note (1): Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note (2): Institutional trust is used as a proxy for social capital.

APPENDIX

Table A-1: Data Definition and Source

Individual-Level Variables*	Definition
Health	Ranges from 1 (poor) to 4 (very good)
General trust (SC)	Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? = 1 if individual reports that most people can be trusted. = 0 otherwise
Informal trust	= 1 if friends are important and = 0 otherwise
Institutional trust	Ranges from 1 to 5 = 1 if individual has confidence in at least 4 out of listed institutions = 2 if individual has confidence in 5 to 8 out of listed institutions = 3 if individual has confidence in 9 to 12 out of listed institutions = 4 if individual has confidence in 13 to 16 out of listed institutions = 5 if individual has confidence in more than 16 out of listed institutions The churches The armed forces The press Television Labour unions The police The courts The government (national) Political parties Parliament The Civil service Universities Major Companies Banks Environmental organizations Women's organizations Charitable/humanitarian organizations Mainland government The United Nations
Age	Age of the individual
Highest education level attained (HC)	1 No formal education 2 Incomplete primary school 3 Complete primary school 4 Incomplete secondary school: technical/vocational type 5 Complete secondary school: technical/vocational type 6 Incomplete secondary: university-preparatory type

	7 Complete secondary: university-preparatory type 8 Some university-level education, without degree 9 University-level education, with degree
Female	= 1 for females and = 0 for males
Class	Ranges from 1 (Upper Class) to 5 (Lower Class)
Being religious	= 1 if independently of attending religious services or not, you say you are a religious person = 0 otherwise
Parent migrated	= 1 if any parent is an immigrant = 0 otherwise
Income group	Income ladder. Ranges from 1 (lowest) to 10 (highest)
Regional Variables**	**Source**
GDP	Government of India Central Statistics Office
Education expenditure Health expenditure Administrative expenditure Development expenditure Social services expenditure	Annual report entitled "State Finances: A Study of Budgets of 2011-12" by the Reserve Bank of India
Unemployment rate	Government of India Central Statistics Office
Literacy rate	Government of India Central Statistics Office
Voter turnout rate for 2009 general elections	https://eci.gov.in/files/file/3151-voters-information/
Governance index 2011	Mundle et al. (2016)

*They are obtained from World Values Survey Wave 6.

**States (and union territory) covered are Andhra Pradesh, Bihar, Chhattisgarh, Delhi (union territory), Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, and West Bengal.

Table A-2: Descriptive Statistics

Variable	Mean	Min	Max	Std. Deviation
Individual-Level Variables				
Health	2.08	1	4	0.86
General trust	0.17	0	1	0.38
Informal trust	0.63	0	1	0.48
Institutional trust	3.75	1	5	1.32
Highest education level attained	4.08	1	9	2.634
Age	41.24	18	92	14.511
Female	0.44	0	1	0.496
Class	3.33	1	5	1
Income scale	4.5	1	10	2.164
Parent migrated	0.058	0	1	0.234
Being religious	0.88	0	1	0.313
Regional Variables				
GDP 2012 Rs. in crores	409 122	93 162	1 248 453	274 063
Education expenditure*	0.207	0.16	0.27	0.028
Health expenditure*	0.045	0.032	0.135	0.024
Administrative expenditure*	0.077	0.043	0.131	0.023
Development expenditure*	0.371	0.227	0.455	0.071
Social services expenditure*	0.158	0.077	0.215	0.037
Literacy rate	76.1	68.5	94	0.094
Unemployment rate	24.12	5	67	14.41
Governance index	0.42	0.29	0.64	0.095
Voter turnout rate	58.81	44.46	81.32	11.18
***as a share of total government spending**				